ADDITIONAL MOONBOUNCE OPERATING AIDS

DIVISION OF VARIAN
301 Industrial Way
San Carlos, California

AS-49-12

RECOMMENDATIONS FOR MOONBOUNCE UNIVERSAL WINDOWS

By: Robert I. Sutherland, W6PO

AS-49-2 titled "Moonbounce Operating Aids", introduced a recommended Universal Window which could be used mostly by the amateurs on the North American and European continents. The Window is a parallelogram with the top and bottom boundaries at $+25.5^{o}$ and $+5.5^{o}$ Declination. AS-49-3 titled "More on the Moonbounce Universal Window for 144 MHz" proposed a Window that had the same top limit to the parallelogram with the lower limit just a little over $+15^{o}$ Declination.

Both of these Windows were accepted by the moonbounce operators. Actually, if the time was reasonable, or it was on a non-working day, the operators would be active one to two hours before the start of the Window. Also, the Universal Window bottom limit of the parallelogram was extended, by common useage, down to 0^{o} Declination. The top limit of the Window parallelogram is set by the moon itself. The moon is heading south on its 18.6 year cycle and therefore the maximum positive Declination will be less each year. For an example, during January, 1976, the maximum North Declination was $+20.5^{o}$. In December, 1976, the maximum Declination will be $+19.3^{o}$. This fact becomes important to consider for operators using a fixed antenna such as a rhombic.

Based on the experience gained from two and one-half years of Universal Window use and the growth in the number of active moonbounce stations, I should like to suggest some changes. Instead of one Window, three Windows may be of interest to the moonbouncer. All three Windows are shown in figure 1.

The first Window would be an extension of the present Universal Window. The top boundary of the Window parallelogram would be the maximum North Declination for the month. The lower limit of the Window would be 0^{o} Declination. The right hand limit, as drawn in figure 1, is the Greenwich Hour Angle (GHA) for the setting moon in Frankfurt, Germany for the various North Declinations of the moon. The Window is shown to be two hours in length. There will be days where the time of the Window occurrence is not convenient. During these times the tendency will probably be for the operators to use the last hour before moonset. The European operators prefer to operate between 144.000 and 144.010 MHz during the Window.

The second Window follows the European Window and is centered about a Greenwich Hour Angel (GHA) of 116^{o}. This meridian can also be described as 116^{o} West Longitude. The length of the Window is a function of the magnitude of the North Declination. The proposed Window should help those stations striving for more states or provinces. The large metropolitan areas have a very severe receiver "birdie" problem in the first 10 kHz part of the 144 MHz band. For this Window, I should like to recommend that 144.050 to 144.060 MHz be the agreed-upon frequencies for random CQing. Conversations with New York City and Los Angeles amateurs indicate that this 10 kHz segment would solve the "birdie" and noise problem. Obviously, for scheduling, the stations setting up the schedule will choose the frequency.

The third Window is based upon the rising moon in Kurume, Japan. The length of the Window has been set at two hours. Again, if the time is inconvenient, the first hour after the rising moon will probably be used. Experience might change this later. When an antenna is pointing at the horizon, the noise can be very severe. The second hour may prove to be the wise choice. A fixed rhombic antenna in Australia will also hit an area of the JA-W Window. As an example, VK6MC's antenna is set up at this time to hit 150^{o} FHA and $+17.5^{o}$ Declination. The frequency of operation recommended by the Japanese and Australian amateurs is 144.000 to 144.010 MHz.

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The third window is based upon the rising moon in Kurume, Japan. The length of the window has been set at two hours. Again, if the time is inconvenient, the first hour after the rising moon will probably be used. Experience might change this later. When an antenna is pointing at the horizon, the noise can be very severe. The second hour may prove to be the wise choice. The fixed rhombic antennas in Australia will also hit an area of the JA-W window. As an example, VK5MC's antenna is set up at this time to hit 150^{o} GHA and + 17.5^{o} Declination. The new frequency allocations in Japan allow space communications in the 144.000 to 144.100 MHz range. JA6DR has indicated he will transmit on 144.055 MHz and tune from 144.050 to 144.060 MHz. At the time of writing this note, VK5MC is operating on 144.007 MHz and tuning from 144.000 to 144.010 MHz.

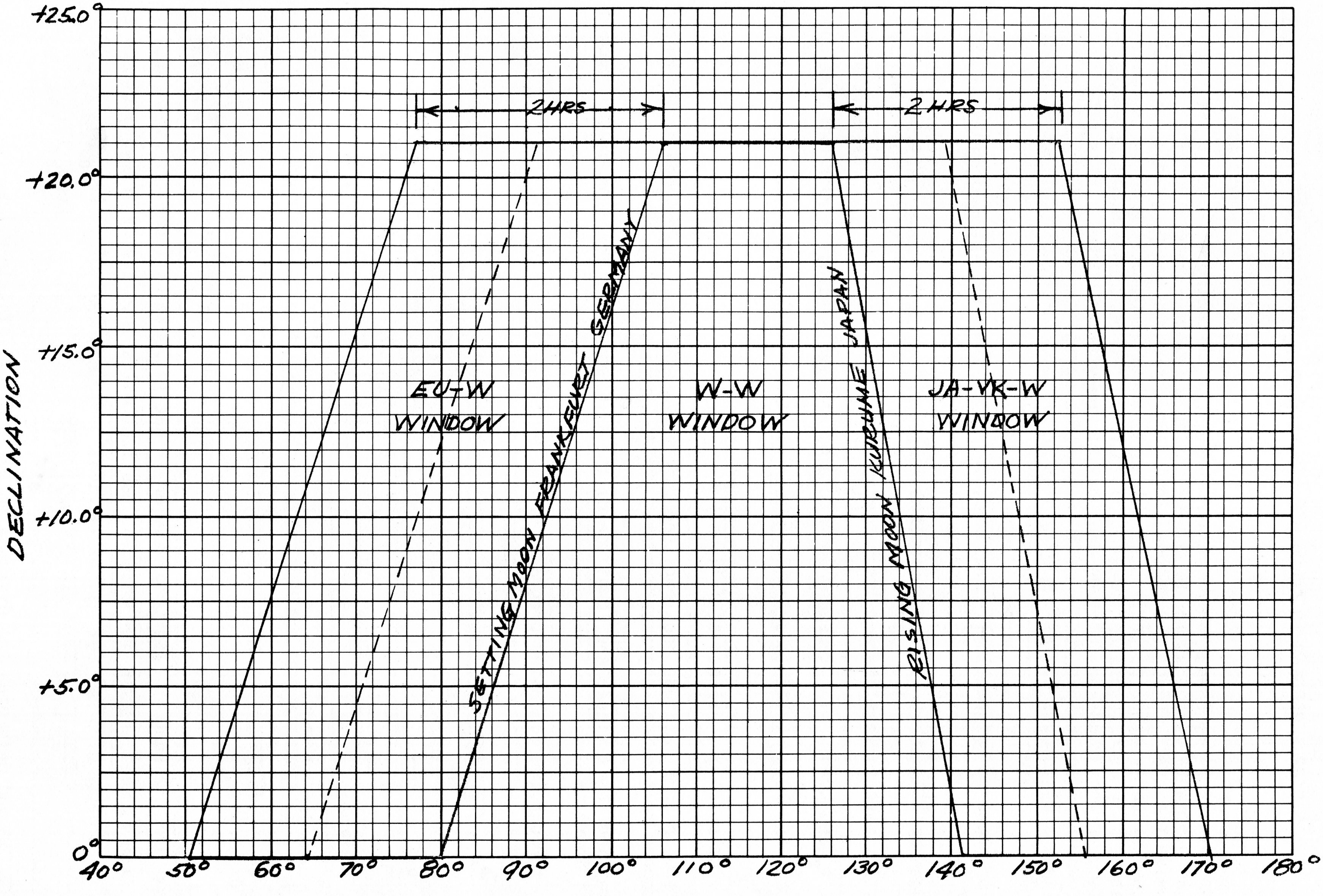

FIGURE 1

TUBE Nº________ PLOTTED BY______ DATE________
COORDINATES: EIMAC 5 X 7 5-17-54

A SIMPLE PROGRAM TO CALCULATE DISTANCE ON A SPHERICAL EARTH

By: J. H. Reisert, W1JAA

One of the first things we do after a QSO is to check the mileage to see what kind of DX we have worked. Sometimes we may even have a computer generated list, but seldom do we have the exact location we need. This simple program can be used on an HP21 or HP35 (and probably other scientific calculators) and will quickly give us the distance in statute miles (the basis for present distance record purposes). All you need to know is your longitude and latitude and that of the station worked. This program is an outgrowth of an example in the HP21 instruction manual and an earlier QST article, "Bearing and Distance Calculations by Sleight of Hand", K1PLP, QST for August 1973, pp 24-26.

For those so mathematically inclined, the basic equation using spherical trigonometry is:

$$\text{Distance} = \cos^{-1}[\sin(Lat_a)\sin(Lat_b)+\cos(Lat_a)\cos(Lat_b)\cos(Long_a-Long_b)] \times 69.0468$$

Where: Distance is in statute miles

Lat_a and $Long_a$ = latitude and longitude of station A (usually your own station)

Lat_b and $Long_b$ = latitude and longitude of station B (usually the station worked)

To do a calculation, proceed as follows:

1. Determine your latitude and longitude (stationA) and convert from degrees, minutes and seconds to straight degrees (example, 37^0 45' converts to 37.75^0).

2. Determine the latitude and longitude of the station worked (station B) and convert as in 1 above.

3. Run through the following program.

1) $Long_a$* $\boxed{\text{ENTER}}$

2) $Long_b$* $\boxed{-}$

3) $\boxed{\cos}$

4) Lat_a* $\boxed{\cos}$

5) $\boxed{\text{X}}$

6) Lat_b* $\boxed{\cos}$

7) $\boxed{\text{X}}$

8) Lat_a* $\boxed{\sin}$

9) Lat_b* $\boxed{\sin}$

10) $\boxed{\text{X}}$

11) $\boxed{+}$

12) $\boxed{\cos^{-1}}$

13) 69.0468 $\boxed{\text{X}}$

14) Answer in statute miles

* Press $\boxed{\text{CHS}}$ if Long is East Longitude or if Lat is South Latitude.

Note: 69.0468 is the constant for changing nautical miles into the desired statute miles.

<u>EXAMPLE</u> W1JAA QTH: Lat_a 42^0 35' N.=42.5833^0
$Long_a$ 71^0 22' 30" W=71.375^0

VK2AMW QTH: Lat_b 34^0 12' S.= -34.2^0
$Long_b$ 151^0 E. = -151^0

Run program and determine the distance to be 10,089.21 statute miles.

HP-25 Program Form

Title: MOONTRACK — Page 1 of 1

Programmer: PAUL SHUCH WA6UAM

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS				OUTPUT DATA/UNITS
1.	ENTER PROGRAM		PRGM ←	STO 7	↓	STO 3	
	Program lists azimuth and		↓	STO 2	COS	RCL 1	
	elevation coordinates for		RCL 3	−	COS	×	
	tracking the moon (or any		RCL 0	COS	×	RCL 2	
	other celestial body),		SIN	RCL 0	SIN	×	
	given its declination and		+	SIN^{-1}	STO 4	3	
	Greenwich hour angle,		6	0	RCL 2	SIN	
	and the latitude and long-		RCL 0	COS	÷	RCL 4	
	itude coordinates of		COS	÷	RCL 4	TAN	
	the observer		RCL 0	TAN	×	−	
			COS^{-1}	RCL 7	x ≠ 0	↓	
			−	RCL 4	→ RUN	CLR PRGM	
2.	STORE COORDINATES:	Lat, Deg N	STO 0				
		Long, Deg W	STO 1				
	Note: North latitudes						
	are +, South latitudes						
	are −.						
3.	EXECUTE:	Decl, Deg N	↑				
	Note: If GHA is to the	GHA, Deg W	↑				
	East (with respect to the	FLAG (0 if E, 1 if W)	R/S				
	observer), FLAG = 0. If						Elevation
	GHA is to the WEST,					↔	Azimuth
	FLAG = 1						
	CHECK:						
	Lat = + 37.3°						
	Long = 121.9°	El = 49.79°					
	Decl = + 20°						
	GHA = 80°	Az = 103.60°					
	(FLAG) = 0						